Dec. 23, 1947. A. M. GUREWITSCH 2,432,989

ELECTRICAL CONNECTOR

Filed Aug. 30, 1944

Fig. 1.

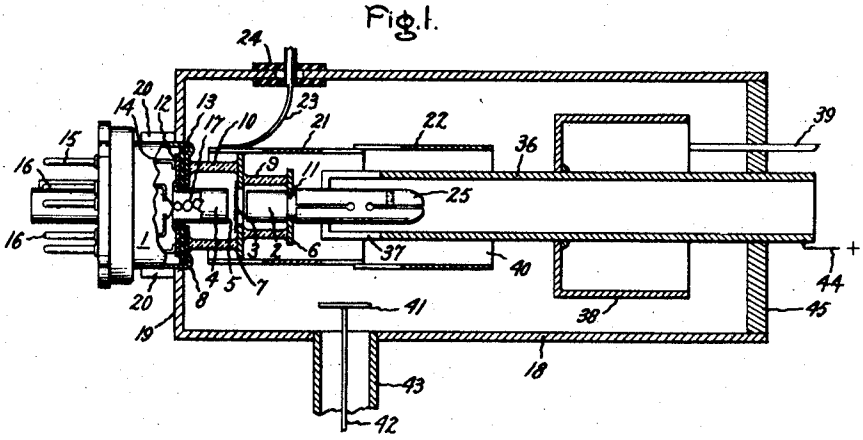


Fig. 2.

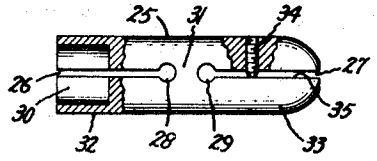


Fig. 3.

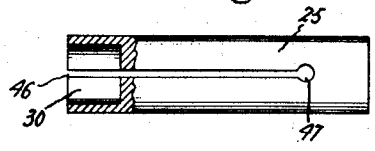
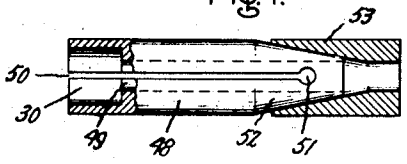


Fig. 4.



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ELECTRICAL CONNECTOR

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Application August 30, 1944, Serial No. 551,894

2 Claims. (Cl. 173—363)

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The present invention relates to electrical connectors and is primarily concerned with an improved connector for extending the tuning range of a high frequency oscillator of the type employed in electric discharge devices as an exciting element.

In my copending application, Serial No. 471,973, filed January 11, 1943, and assigned to the assignee of my present application, there is disclosed an ultra high frequency reentrant oscillator which employs coaxial cylinders forming a cavity resonator and a vacuum triode which is adapted to be inserted longitudinally into the cylinders and having disk electrodes for contacting an intermediate cylinder and a tubular electrode for contacting the inner cylinder. I have found that one of the limitations on the tuning range of a reentrant oscillator of the type disclosed in this application is the length of the external anode connection of the electric discharge device. It is an object of the present invention to provide a new and improved contact for the anode connection of such a device which permits increased adjustment in the tuning of the cavity resonators.

It is a further object of my invention to provide a new and improved contact making arrangement for a tubular electrode.

It is a still further object of my invention to provide a new and improved apparatus for extending the tuning range of a reentrant type oscillator employing an electric discharge device as an exciting element.

It is still another object of my invention to provide a new and improved contact making arrangement for a tubular electrode which permits the establishment of high contact pressures on the electrode.

One of the features of the invention consists in the use of a cylindrical conductive member which is adapted to slip over a tubular electrode, the conductive member being slotted longitudinally and being provided with means for positively establishing a high contact pressure on the electrode. The cylindrical conductive member is adapted to be slipped over the anode terminal of a device used to excite a cavity resonator and facilitates adjustment of the dimensions of the resonator and the tuning range of the oscillator by providing a smooth surface along which one of the walls of the resonator may be adjusted.

The features of the invention desired to be protected herein are pointed out in the appended claims. The invention itself, together with its

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further objects and advantages, may best be understood by reference to the following description taken in connection with the drawing in which Fig. 1 is a longitudinal sectional view of a high frequency oscillator suitably embodying the invention; Fig. 2 is an enlarged view of the anode contact employed in the oscillator of Fig. 1; and Figs. 3 and 4 are modifications of the anode connector of the invention.

Referring particularly to Fig. 1, there is shown an oscillator having as its central element a high frequency electric discharge device, such as the triode 1, which is of a type particularly described and claimed in application, Serial No. 436,633, filed March 28, 1942, issued as Patent No. 2,416,565 on February 25, 1947, in the name of James E. Beggs and assigned to the assignee of the present invention.

The tube 1 comprises a cylindrical anode 2, a grid 3, and a cylindrical cathode 4, the latter having its emissive part in the form of a flat disk 5 which faces the grid. The envelope within which these electrodes are enclosed comprises a series of three circular metallic parts 6, 7, and 8 which are supported in spaced relation by glass cylinders 9 and 10 sealed between them. The disk 7 provides a terminal for the grid 3 and a terminal for the anode is provided by a cylindrical external electrode 11 which is welded or soldered against the upper surface of the disk 6. The cathode 4 is provided at its lower extremity with a flange 12 which parallels the under surface of the part 8, but which is separated from that part by an insulating spacer 13, e. g., a mica washer. With this arrangement, the part 8 has a high frequency connection with the cathode through the capacity existing between this part and the flange 12 but is effectively insulated from the cathode as far as direct currents are concerned. Separate direct current connections are made to the cathode by means of lead-in wires 14 secured to the under surface of the part 12 and terminally connected to prongs 15 which depend from the base of the discharge tube. Additional prongs 16 are provided for the purpose of supplying heating current to a coiled filament 17 arranged within the cathode cylinder 4.

The oscillating system in which the tube 1 is incorporated comprises a cavity resonator structure having, as a principal component, an elongated conductive cylinder 18 which surrounds the tube 1 and is symmetrical with respect to the axis of alignment of the electrodes of the tube. A conductive flange 19 extends inwardly from the interior wall surface of the cylinder 18

and contacts at its inner periphery the outer surface of the member 8. To this end, the part 19 may be provided with a plurality of spring fingers 20. The grid terminal 7 is peripherally connected to a tubular conductor 21 having a telescoping part 22. The conductor 21 at its ends is slotted to provide a plurality of fingers for engaging at the one end the disk electrode 7 and at the other end the telescoping tube 22. A terminal wire 23, which extends through an insulating bead 24, provided in the wall of cylinder 18, contacts the outer surface of the cylinder 21 for making external connections thereto.

A longitudinal cylindrical contact making member 25 is adapted to slip over the tubular electrode 11 for connection to a source of unidirectional currents in a manner to be pointed out later. The conductive member 25 is shown in enlarged view in Fig. 2 and comprises a cylinder of conductive material, such as copper or brass preferably silver-plated, and having longitudinal slots 26, 27 terminating, respectively, in transverse openings 28, 29. Moreover, the left-hand end of the member 25 is provided with recess 30, substantially the size of the anode electrode 11, which when pushed over the electrode 11 is adapted to make a tight fit therewith. The portion 31 of the cylinder 25 between the transverse openings 28, 29 functions as a hinge or fulcrum around which the lever arms 32, 33 may be turned by means of a screw 34 engaging threads in the upper portion of the arm 33 and extending therethrough to contact the lower surface 35 of the slot 27. It is apparent that, as screw 34 engages the surface 35, the width of the slot 26 is decreased and the member 25 is made to grip firmly the tubular electrode 11. By variation of the position of the fulcrum 31 and the lengths of the lever arms 32, 33, any desired contact pressure on the electrode 11 may be obtained.

Centrally positioned within the conductive member 18 (Fig. 1) is a conductive tube 36 provided at its left-hand end with a plurality of contact fingers 37 adapted to engage the outer surface of the contact member 25. The anode connector 36 carries on its external surface an anode choke 38 in the form of a conductive cylinder welded to the outer surface of the member 36 and extending therealong for a distance equal substantially to a quarter wave length at the midband frequency of the range over which the oscillator operates. Adjustment of the position of the anode connector 36 and the choke 38 within the member 18 may be made by means of any suitable positioning means, such as the rod 39 attached to the member 38.

Viewing the structure of Fig. 1 as a device for generating sustained oscillations, it may be noted that the members 18 and 38 define a cavity resonator terminated at one end by the conductive wall 19 and at the other end by the choke 38. The triode 1 provides means for exciting the resonant system provided by the cylinders 18 and 36. When voltage variations are caused to occur between the grid and anode of tube 1 at the resonant frequency of the cavity resonator (as modified by the presence of the tubular conductors 21, 22, the member 25 and the tube 1), electromagnetic waves of the resonance frequency may be established in the cavity-forming space. Such waves, which are initiated in the vicinity of the grid-anode gap and propagated from this point throughout the remainder of the resonator, are governed by the presence of the conductive tubes 21, 22 which tend to combine or guide the

waves along the annular space between these tubes and the outer surface of the cylinder 36. In the extremities of the tubes 21, 22, the waves are free to pass through the gap 40 between this cylinder and the cylinder 36. The energy emerging from the gap 40 may flow in the reverse direction along the outside of the conductors 22, 21 toward the vicinity of the cathode-grid gap of the triode 1. If the length of the propagating path from the grid-anode gap to the grid-cathode gap is a full wave length or an integral number of wave lengths at the operating frequency, waves arrive at the cathode-grid gap in proper phase relationship to sustain oscillations within the high frequency system. The desired amplitude of the waves arriving at the cathode-grid gap is determined by adjusting the size and configuration of the cylinders 18 and 36 and the telescoping cylinders 21, 22.

In order that high frequency energy may be taken from the oscillator for utilization in an external circuit, there is provided a coupling electrode 41 connected to a lead-in conductor 42 surrounded by a conductive cylinder 43 terminating in an aperture in cylinder 18 and forming with the conductor 42 a concentric transmission line over which high frequency energy may be transmitted. An anode lead-in conductor 44 is connected to the right-hand end of the anode cylinder 36 and may supply unidirectional current thereto from any suitable source. A metallic member 45 serves to close the right-hand end of cylinder 18 and to support the anode tube 36 and the rod 39.

It will be understood that tuning of the oscillator may be obtained by adjusting the location of the tuning plunger 38 which defines one end wall of the cavity resonator. The cylindrical contact 25 permits a wide range of such tuning by providing a surface considerably larger than the longitudinal surface of the anode electrode circuit along which the contact fingers 37 may slide. The use of the contact 25 to engage the anode electrode 11 compensates for variations in diameter of anode electrodes and permits a greater range of the tuning adjustment.

Fig. 3 illustrates a modified form of anode contact in which the cylinder 25 is provided with one or more longitudinal slots 46 cut from the left-hand end of the member 25 and terminating in transverse openings 47. The right-hand end of the member 25 is of solid structure and the slots 46 provide a plurality of spring fingers which, regardless of variation in anode diameters, assure a good contact.

In the modification of the tubular electrode contact shown in Fig. 4, the cylinder 48 is provided with a recess 30 for engaging an anode electrode and a longitudinal aperture 49. One or more slots 50 extending from the left-hand end of the terminal 48 terminate in transverse openings 51. In order to provide means for exerting high contact pressure on the tubular electrode, the member 48 at its left-hand end has a tapered conical surface 52 over which is adapted to slide a tapered sleeve 53. It is apparent that, by adjustment of the position of sleeve 53 on the conical surface 52, any amount of pressure on a tubular electrode within recess 31 may be obtained.

An important advantage of the tubular electrode contact making arrangement of my invention is that it compensates for the wide range in variations in the size of anode contacts of the electric discharge devices of the type illustrated. By providing a fulcrum and a lever arm arrange-

ment sufficient pressure on a tubular contact is obtained to assure good conductive connection therewith. Moreover, the contacts provide smooth adjustment of the frequencies of large amounts of ultra high frequency power over a wide range without introducing undesirable reflections of energy.

Systems of the type illustrated by the Figure 1 employing means such as the telescoping cylinders **21** and **22** for controlling the feed-back path with or without variable means such as the choke **38** for adjusting the frequency of the cavity resonator are broadly claimed in my aforesaid copending application Serial No. 471,973, filed January 11, 1943. Means for slideably mounting the cylinder **22** upon the cylinder **21** by means of spring fingers are claimed in my co-pending application Serial No. 550,758, filed August 23, 1944.

While the invention has been described by reference to particular embodiments thereof, it will be understood that numerous modifications may be made by those skilled in the art without departing from the invention. I therefore aim in the appended claims to cover all such equivalent variations as come within the true spirit and scope of the foregoing disclosure.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A connector comprising a conductive member having a recess at one end thereof for receiving a conductor, said member having a pair of parallel longitudinal slots extending from the opposite ends thereof defining lever arms pivoted about the portion of said member interconnecting said slots, and means for exerting a force on the lever arm remote from said recess for gripping the conductor in said recess.

2. A connector comprising a conductive member having a recess at one end thereof for receiving a conductor, said member having a pair of longitudinal slots extending from the opposite ends thereof and a portion intermediate between the inner ends of said slots, the portions of said member defining said slots constituting lever arms pivoted about said portion intermediate between the inner ends of said slots, and means for exerting a separating force between the said portions defining opposite sides of the one of said slots remote from said recess whereby the said portions defining opposite sides of the other of said slots may be caused to grip said conductor in said recess.

ANATOLE M. GUREWITSCH.

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